D4

PATENT SPECIFICATION

603,837

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Complete Specification Accepted: June 23, 1948.

Index at acceptance:—Classes 7(ii), B2a(10c: 11c: 13c); and 7(vi), B2q5(a: b).

COMPLETE SPECIFICATION

Improvements in Rotary Sleeve-valve Internal-combustion Engines

We, JACK & HEINTZ, INC., a corporation organized and existing under the laws of the State of Ohio, of Solon Road, Bedford, State of Ohio, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates in general to rotary sleeve valve internal combustion engines having a sleeve valve coaxial with the cylinder and has for one of its objects to provide an improved multiple port system for intake and exhaust that will provide for a greater combined number of intake and exhaust ports leading to the intake and exhaust manifolds than the number of ports in the rotary sleeve valve itself.

One of the primary objects is to provide such a system as above mentioned that will insure a more efficient charge of intake combustible gases by an improved design of intake and exhaust ports so correlated with respect to the rotary sleeve valve that all of a greater number of intake ports are open during the intake stroke than all of the exhaust ports which are open during the exhaust stroke of the engine.

Another object is to further enhance the efficiency of the charge by allowing for a predetermined small degree of overlap during the last stages of the exhaust stroke during which the intake parts are beginning to open, such overlap, of course, being correlated also to the timing cycle of fire.

With the foregoing objects in view the invention consists in a rotary sleeve valve engine including an exhaust manifold and an intake manifold, a cylinder having a plurality of exhaust ports leading to the exhaust manifold and a greater number of intake ports leading to the intake manifold and a rotary sleeve valve for regulating the opening and closing of the intake and exhaust ports, the number of ports on the valve being less than the combined number of intake and exhaust ports.

An embodiment of the invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a schematic view of a fragmentary portion of the engine showing in cross section the intake and exhaust ports and manifolds and the rotary sleeve valve in their respective positions at the start of stroke;

Figure 2 is a similar view taken during the intake stroke;

Figure 3 is a similar view taken during the compression stroke;

Figure 4 is a similar view taken during the explosion stroke;

Figure 5 is a similar view taken during the exhaust stroke; and

Figure 6 is a view in vertical section through a cylinder showing the valves and porting arrangement, the piston being shown in elevation.

Referring more particularly to the drawings, the engine includes a cylinder 1 with intake ports 2, 3, 4 and 5 leading into an intake manifold 6 and exhaust ports 7 and 8 leading into an exhaust manifold 9. The stationary inner sleeve 10 has ports 2^1, 3^1, 4^1, 5^1, 7^1 and 8^1 in alignment with ports 2, 3, 4, 5, 7 and 8. Intermediate the cylinder 1 and the inner stationary sleeve 10 is a rotary sleeve valve 11 having ports 12, 13, 14, 15 and 16 of the same size each as the cylinder and stationary sleeve ports. This arrangement provides for four intake ports leading into the cylinder from the intake manifold and two exhaust ports leading from the cylinder to the exhaust manifold.

The rotary sleeve valve 11, however, is provided with five ports 12 to 16, inclusive. The relative positions of the rotary sleeve valve and its ports with respect to those of the cylinder and stationary sleeve

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Price 2/-

during the intake stroke is shown in Figure 2. Here valve port 12 is in full registry with intake ports 2 and 2¹, valve port 13 with ports 3 and 3¹, valve port 14 with ports 4 and 4¹ and valve port 15 with ports 5 and 5¹. It will be noted that valve port 16 is between exhaust 7, 7¹ and 8, 8¹ which exhaust ports are closed by the rotary sleeve valve.

The rotation of the rotary sleeve valve is in a counterclockwise direction so that during the compression stroke of the engine, as shown in Figure 3, the intake as well as the exhaust ports are all closed by the rotary sleeve valve. Valve port 12 is between cylinder intake ports 2 and 3, valve port 13 between intake ports 3 and 4, valve port 14 between intake ports 4 and 5, valve port 15 between intake port 5 and exhaust port 7 and valve port 16 between exhaust ports 7 and 8.

As shown in Figure 4, during the explosion stroke the rotary sleeve valve has moved to a position where all of the intake and exhaust ports still remain closed and the valve ports still located between the respective cylinder ports as mentioned in connection with Figure 3 but moved further in a counterclockwise direction.

During the exhaust stroke, as shown in Figure 5, the rotary sleeve valve ports 15 and 16 have come into full registry with cylinder exhaust ports 7 and 8 and the corresponding inner sleeve ports 7¹ and 8¹. The sleeve valve in this position still maintains the intake ports 2, 3, 4 and 5 closed. The valve port 12 is between intake ports 2 and 3, valve port 13 between intake ports 3 and 4 and valve port 14 between intake ports 4 and 5.

The cycle of operation just described for the intake, compression, explosion and exhaust strokes involves the following degrees of a 360° rotation of the rotary sleeve valve: for intake, 27°, for compression 10.5°, for explosion, 10.5° and for exhaust 27°. This makes a total of 75°, which calls for a total of 3° overlap for each valve port. The rotary sleeve valve makes one complete revolution for each five complete cycles of the four cycle engine, the cycle of operation of which has been above described.

This may be best understood by reference to Figure 1, which represents a step in the operation of the sleeve valve intermediate the exhaust stroke, as shown in Figure 5, and the intake stroke, as shown in Figure 2. Figure 1 shows the intake ports 2, 3, 4 and 5 and the exhaust ports 7 and 8 to be partially open. The sleeve valve port 12 is in partial registry with exhaust port 8 and intake port 2, valve port 13 with intake port 3, valve port 14 with intake 4, valve port 15 with intake port 5 and valve port 16 with exhaust port 7. This is the relationship that exists between the valve ports and the intake and exhaust ports at the start of the stroke. One and one-half degrees of this 3° overlapping of the valve ports occurs during the last stages of each exhaust stroke as valve ports 12, 16, 15, 14 and 13 respectively assume the position that valve port 12 does in Figure 1 in which it overlaps intake port 2 and exhaust port 8. The other one and one-half degrees of the 3° overlap continues during the initial stages of the intake stroke. The sleeve valve makes one revolution as the four cycle engine operates through five complete cycles.

From the foregoing it will be seen that the six engine cylinder ports, including four intake ports and two exhaust ports, are controlled by a rotary sleeve valve having only five ports. While six cylinder ports have been shown and described, it is to be understood that any suitable number of cylinder ports may be used. The sleeve valve will have a lesser number of valve ports than the combined number of cylinder intake and exhaust ports, regardless of their number. It is to be borne in mind that the rotary sleeve valve ports 12 to 16, inclusive, are equidistantly spaced throughout the 360° of the sleeve valve 11. It is during the exhaust stroke, and the latter part thereof, that the sleeve valve has moved from its position of having its ports 12 and 16 in full alignment with cylinder ports 8 and 7 (in the same manner as valve ports 16 and 15 are shown in registry with cylinder ports in Figure 5) to a position as shown in Figure 1 wherein 1½° of valve port 16 is in registry with exhaust port 7 and valve port 12 is 1½° in registry with exhaust port 8 and 1½° in registry with the intake port 2 and valve ports 13, 14, 15 and 16 are 1½° in registry with ports 3, 4, 5 and 6. This condition prevails, as shown in Figure 1, at the start of the stroke, or when the piston is at top dead centre and of course is properly correlated with the engine timing.

As an example of measurement of the various ports and the distances therebetween with respect to 360° of a complete circle, and as shown in Figure 5, each of the sleeve valve ports 12 to 16 inclusive, and each of the cylinder ports 2 to 5, inclusive, 7 and 8 and 2¹ to 5¹ inclusive, 7¹ and 8¹ measure circumferentially 13½° each, the distance between intake ports 2 and 3, 3 and 4, 4 and 5 and exhaust 7 and 8 meaures 58½°, the distance between intake port 5 and exhaust port 7 measures 34½° whereas the distance be-

tween exhaust port 8 and intake port measures 10½°.

The particular arrangement of the intake ports with respect to the exhaust ports, the fact that the number of intake ports, four in number, exceeds the number of exhaust ports, two in number, and the manner of valving them with the five port rotary sleeve valve predeterminedly correlated to the engine timing as described, all make for an increased efficiency in operation and in the provision and maintenance of a proper combustion charge in the cylinder explosion chamber. The charge is initiated from the intake manifold under pressure through the four intake ports the flow of which is augmented by the accelerated flow of the exhaust gases through the exhaust ports so as to more nearly insure the complete discharge of the exhaust gases to increase the efficiency of the combustion charge during the intake stroke.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A rotary sleeve valve engine including an exhaust manifold and an intake manifold, a cylinder having a plurality of exhaust ports leading to the exhaust manifold and a greater number of intake ports leading to the intake manifold and a rotary sleeve valve for regulating the opening and closing of the intake and exhaust ports, the number of ports on the valve being less than the combined number of intake and exhaust ports.

2. A device as claimed in claim 1 in which the exhaust ports are progressively closed during the latter stages of the exhaust stroke of the engine.

3. A device as claimed in claim 2 in which the intake ports are uniformly partially open at the top dead centre position of the piston of the engine.

4. A device as claimed in any preceding claim in which there are four intake and two exhaust ports of equal size each embracing 13½° of a total circumference of 360°, the four intake ports being adjacently spaced 58½° from each other and the two exhaust ports being adjacently spaced 58½° from each other, one of the exhaust ports being spaced 34½° from its adjacent intake port and the other exhaust port being spaced 10½° from its adjacent intake port.

5. A device as claimed in claim 4 in which each of the four intake ports are open 1½° when the piston is at top dead centre.

6. A rotary sleeve valve engine as claimed in claim 1 substantially as described with reference to the accompanying drawings.

Dated this 28th day of December, 1945.
MARKS & CLERK.

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[This Drawing is a reproduction of the Original on a reduced scale.]

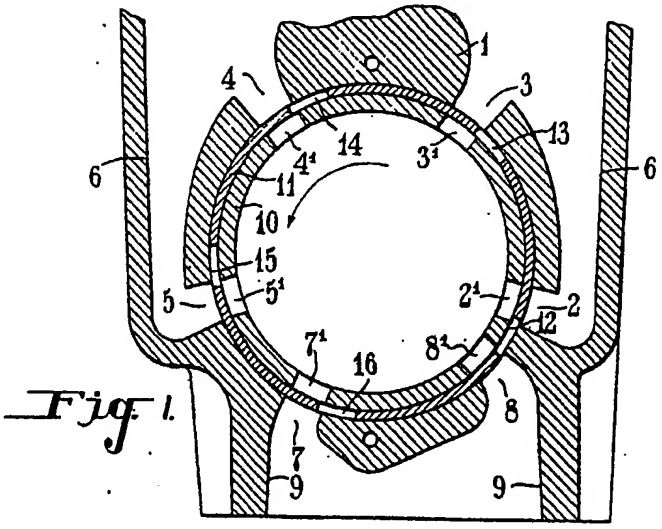


Fig. 1.

Fig. 2.

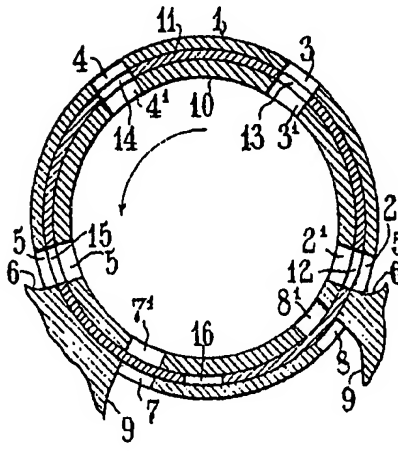
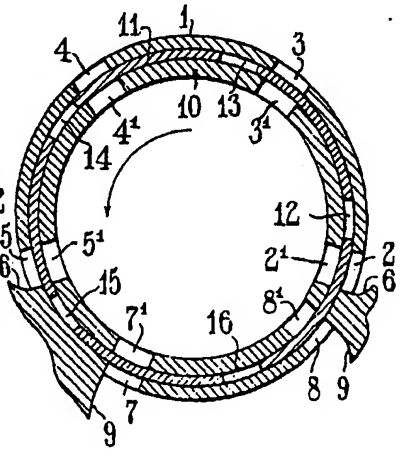


Fig. 3.



3 SHEETS

SHEET 1

SHEET 2

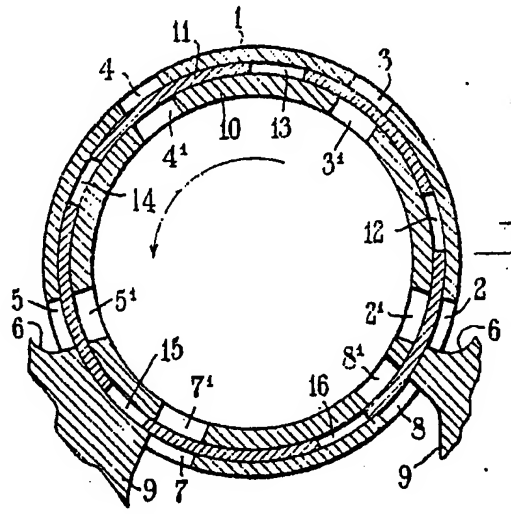
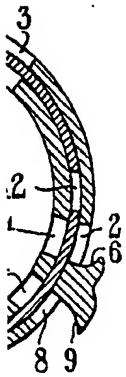


Fig. 4.



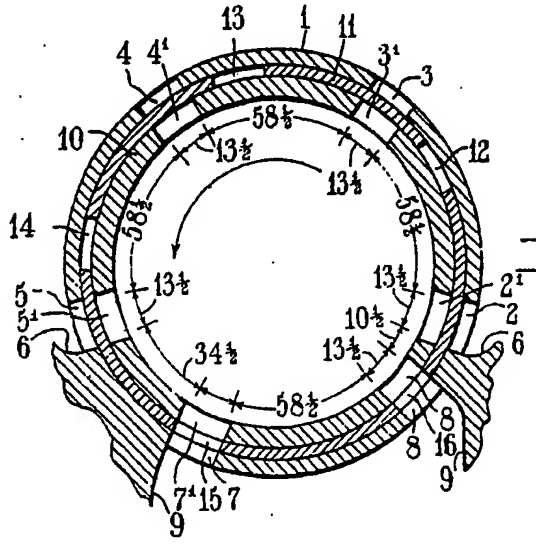


Fig. 5.

H.M.S.O.(Ty.P.)

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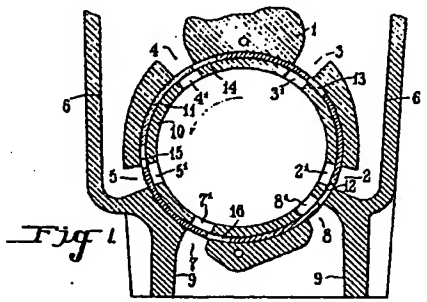

Fig. 1

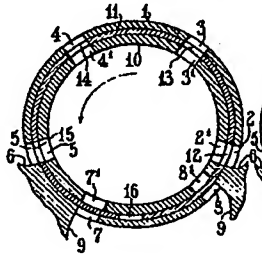

Fig. 2

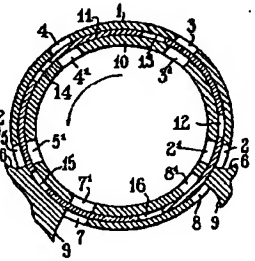

Fig. 3

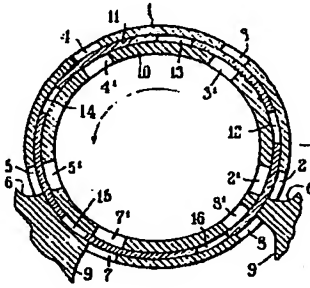

Fig. 4

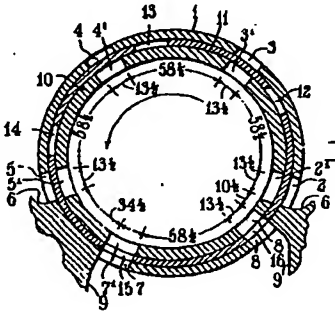

Fig. 5

H.M.S.O.(Ty. P.)

[This Drawing is a reproduction of the Original on a reduced scale.]

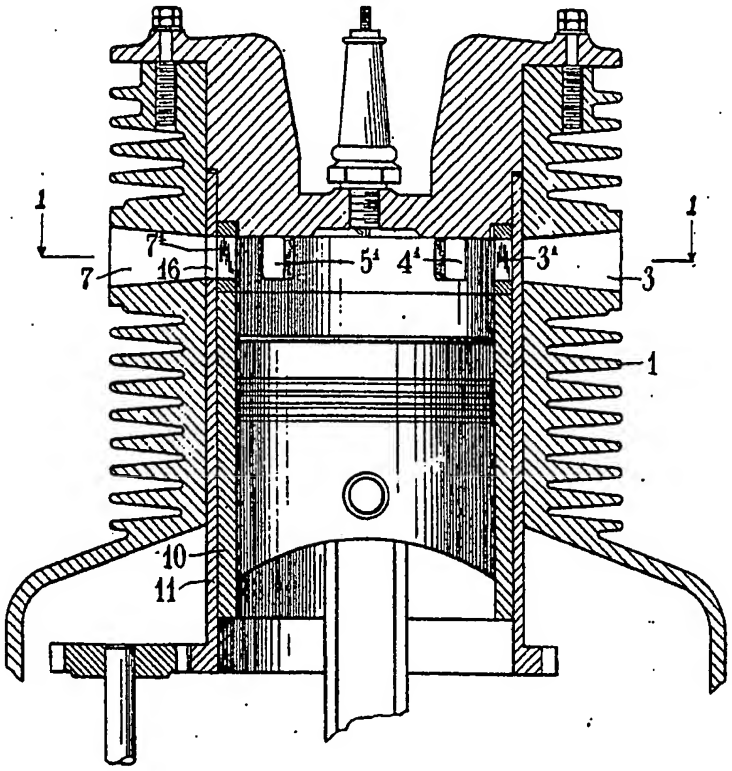

Fig. 6

H.M.S.O. (Ty. P.)